## A146 The Biomechanics and Composition of Juvenile Pig Ribs in Relation to the Postmortem Interval in a Subaerial Environment

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After attending this presentation, attendees will better understand how change in the chemical composition of juvenile porcine rib bone correlates with change in the material properties of the same bone over the early postmortem period in a subaerial exposure environment.

This presentation will impact the forensic science community by providing experimental data that informs how changes in bone composition over the postmortem period affect its material properties and the biomechanics of bone response to localized loading, and thus informs regarding the factors that affect fracture timing determination.

When performing trauma analysis, forensic anthropologists are often faced with the challenge of determining fracture timing based on bone characteristics, a critical step in ascertaining the circumstances of death. Bone fracture characteristics used to differentiate between peri-mortem and postmortem fractures are discussed in terms of occurring in "fresh" bone versus "dry" bone, and yet it is still unclear how long into the postmortem period bone can retain its fresh fracture characteristics, particularly in juveniles. Rib fractures represent one of most common occurrences among the pediatric population being involved in a number of fatal circumstances; however, little experimental data have been generated about rib fracturing in juveniles.

This study uses a juvenile porcine model to examine the relationship between the length of the postmortem interval in subaerial exposure environments and the association between changes in: (1) the biomechanical properties of juvenile ribs in response to localized load; and, (2) the chemical composition of juvenile bone.

Twenty-seven suckling piglets (*Sus scrofa*) aged approximately between two and eight weeks were purchased from a local supplier. Their rib cages were manually disarticulated and defleshed, and each rib cage was divided into right and left halves. Three half rib cages (*sub-sample*=45 ribs) were placed on top of a soil-filled container, and a total of 16 soil-filled containers (*total sample*=720 ribs) were studied over a period of 12 months. The first subsample was removed from the container after one week, the subsequent three subsamples were removed one week apart, the following two subsamples two weeks apart, and the remaining ten subsamples four weeks apart, in a total of 16 trials. Sub-samples were randomly assigned to each container. Twenty to 27 ribs were selected from each subsample/trial and fractured experimentally using a three-point bending test. This was performed to quantify mean peak stress and mean tissue modulus for each subsample. Nine of the experimentally fractured ribs in each trial were sectioned to quantify water, collagen, and mineral content through a process of sequential controlled heating. Each sample was weighed four times throughout the process, and the water, collagen, and mineral contents were expressed as a percentage of total weight.

Peak stress and tissue modulus increase up to the fourth month, then level off. Results from the analysis of bone composition revealed a noticeable increase, then a significant decrease ($p \leq 0.01$) in collagen within the first month, and a noticeable decrease, then a significant increase ($p \leq 0.001$) in mineral within the same period of time. Both collagen and mineral were relatively unchanged from week four on. Results did not exhibit a clear trend for changes in water content throughout the postmortem period. No clear relationship was observed between changes in composition and material properties of bone over the postmortem period in this experiment. These results may be affected by residual desiccated soft tissue or environmental factors, such as variation in temperature and humidity.

**Fracture Timing, Collagen, Bone Stiffness**



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